

described in Anton August Heinrich Lichtenstein's 'Catalogus'* have been noticed by Wiedemann or any other author. Bezzi (*loc. cit.* note 2) gives the number of the species under the genera under which they were described, but states that he has not yet seen the publication in question. This is not surprising, since, according to Sherborn (*Ann. & Mag. Nat. Hist.* ser. 7, vol. iii. 1899, p. 272), Lichtenstein's 'Catalogus' is "so rare that only two copies are known to exist, one in the British Museum and one in the University of Kiel." Lichtenstein's Tabanidæ were described as *Tabanus costalis* (*op. cit.* p. 213) and *Tabanus Hottentotus* and *T. charopus* (*ibid.* p. 214). The descriptions are exceedingly short, and since few dipterists are likely to be in a position to consult the originals, they are transcribed in their entirety below, with a note in each case on the systematic position of the species:—

"295. *Tabanus striatus*; n. 39 †. Item: *Tabanus costalis*; nobis. *Taban. oculis æneis*; ferrugineus, alis hyalinis costa flava. Habitat in Coromandel."

[Apparently a *Tabanus*, but precise species probably indeterminable.]

"304. *Tabanus Hottentotus*; nobis. *Tabanus ater*; thorace, & abdominis segmento tertio supra flavo macularis [*sic*]. Habitat ad Cap. bon. Spei. Haustellum longitudine capitis, alæ nigæ."

[Evidently a *Cadicera*, near, though apparently distinct from, *C. (Fangonia) chrysostigma*, Wied.]

"305. *Tabanus charopus*; nobis. *Tabanus oculis fuscis*, ater, lanugine alba, alis hyalinis. Habitat ad Cap. bon. Spei. Haustellum longitudine thoracis."

[Probably *Bombylius anatis*, Fabr., ♂.]

LV.—*The Missing Premolar of the Chiroptera.*

By OLDFIELD THOMAS.

No bat has normally more than three premolars, above or below, and the question has naturally arisen as to which of the full mammalian set of four has disappeared in this group.

* 'Catalogus rerum naturalium rarissimarum Hamburgi . . . auctionis lege distrabendarum . . .' Sectio tertia [Insecta]. 8vo, Hamburg, 1796.

† The number under which *Tabanus striatus* was originally described by Fabricius, *Ent. Syst.* iv. 1794, p. 371.—E. E. A.

Hitherto authors have taken for granted that the anterior tooth, the protus* or p^1 , was the missing one; but they appear to have done this rather because it was the simplest theory than that they had any strong reason for it. Even Winge, who gives in most cases such full reasons for his conclusions, merely says "it is usually presumed that it is p^1 which is absent"†.

In such cases the arguments that are available are of three kinds, viz.: (1) relative position in the jaw, (2) the occasional recurrence of atavistic teeth, and (3) the presence or absence of milk-teeth corresponding to the permanent ones. The first two of these arguments may often be fallacious, while the third is a very important one; but if, as now, all three agree in pointing to one conclusion, that should be accepted even if it differs from the usual opinion on the subject.

It is, of course, certain that the two posterior premolars of bats are to be homologized as p^3 and p^4 , tritus and tetartus; and the question to be settled is as to whether the most anterior one is the protus or deuterus, p^1 or p^2 , and I have come to the conclusion that this tooth is the protus and that the deuterus is missing, for the following reasons:—

(1) As to relative position, attention may be drawn to the way in which the anterior tooth in *Pterocyton helvus*, in *Lonchoglossa*, and others, stands close behind the canine, with a gap separating it from the other teeth.

(2) Dr. K. Andersen has shown me a skull of *Pteropus scapulatus* (B.M. no. 86. 11. 1. 1) in which the mandible possesses on one side a well-developed tooth standing in the gap thus formed, and, I would suggest, representing the missing p^2 . The additional premolar described by Peters‡ in a specimen of *Anoura geoffroyi* is again in an exactly similar position, and may be equally of an atavistic nature.

(3) The really important test as to whether a tooth is a p^1 or p^2 is, among the Ferae, as to whether it does or does not have a milk predecessor, no protus in the group being known to change §, while the deuterus is always represented by both

* Cf. P. Biol. Soc. Wash. xviii. p. 196 (1905).

† "Pattedyrenes Tandskifte," in Vid. Medd. Nat. For. Copenhagen, 1882, p. 62.

‡ MB. Ak. Berl. 1869, p. 398.

§ A case contradicting this rule would appear to be represented by the mole's dentition as described by Tauber (Naturh. Tidsskr. (3) viii. p. 252, pl. xi., 1872), but, judging by the figure, his interpretations are palpably incorrect. Taking his own diagram, no one could hesitate in deciding that the teeth he calls *ml.* 1 in the upper jaw and *pm.* 1 in the lower correspond absolutely with each other, instead of one being milk and the other permanent. The true explanation of his drawing is evidently that

milk and permanent teeth. Now, with one exception, explained below, no bat has ever been recorded as having more than two milk-premolars, those belonging to the two posterior teeth, the tritus and tetartus. The anterior Chiropteran cheek-tooth therefore never changes, and is, *ipso facto*, p^1 (unless it is mp^1 , a possibility about which I cannot at present express any opinion, though I do not think it unlikely). That the absence of the milk-tooth cannot be correlated with the reduction that the anterior permanent tooth generally exhibits is shown by the fact that in *Pterocyon helvus* this premolar is decidedly larger than the incisors, and yet no trace of a milk-tooth belonging to it is to be found, while the milk-incisors are large and conspicuous.

The one exception referred to is Leche's record of three upper milk-premolars in *Glossophaga**, although the adult has only two permanent premolars. But this latter fact gives the clue to the apparent anomaly of the *Glossophaga* dentition, for to my mind it indicates without doubt that the anterior cheek-tooth regarded by Leche as a milk-tooth is simply the ordinary anterior premolar itself, somewhat premature in development and deciduous in the adult.

As I agree with Dr. Knud Andersen that it is the outer and not the median upper incisor that has disappeared in bats †, the following would be the full Chiropteran formula when at its maximum :—

$$I. \begin{Bmatrix} 1 & 2 & 0 \\ 1 & 2 & 0 \\ 1 & 2 & 3 \\ 1 & 2 & 3 \end{Bmatrix} C. \begin{Bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{Bmatrix} P. \begin{Bmatrix} 1 & 0 & 3 & 4 \\ 0 & 0 & 3 & 4 \\ 0 & 0 & 3 & 4 \\ 1 & 0 & 3 & 4 \end{Bmatrix} M. \left\{ \frac{1 \ 2 \ 3}{1 \ 2 \ 3} \right\} \times 2 = 22. \ 38.$$

the teeth just mentioned are the non-changing protus and protid, while the objects he labels as *pm.* 1 above and *md.* 1 below are not teeth at all, but soft structures which he has mistaken for such in the belief that teeth ought to be found there.

* Lunds Univ. Arsskr. xiv. p. 11, pl. ii. fig. vii. (1878).

† Partly because of the reduction of the third lower incisor in many bats, partly because of the way the lower canine bites on to the space where a missing i^3 would have stood, and partly on the analogy of such other members of the Feræ as *Centetes*, where this reduction can be clearly proved (see P. Z. S. 1892, p. 504). Mr. Miller's argument ('Genera of Bats,' p. 27, 1907) about the median imperfection of the premaxillæ appears to me quite fallacious, for the innermost incisor of three, in one geological epoch, would not be affected by the fact that in a later one, *after* the reduction to two incisors, the premaxillæ were *going* to become imperfect in the middle line of certain genera. The reduction from three to two must have taken place long before any tendency to premaxillary imperfection began to appear.